

Water quality — Determination of the elimination and biodegradability of organic compounds in an aqueous medium — Activated sludge simulation test

The European Standard EN ISO 11733:2004 has the status of a British Standard

ICS 13.060.70

Confirmed July 2008

National foreword

This British Standard is the official English language version of EN ISO 11733:2004. It is identical with ISO 11733:2004. It supersedes BS EN ISO 11733:1998 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee EH/3, Water quality, to Subcommittee EH/3/5, Biological methods, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

Cross-references

The British Standards which implement international publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, the EN ISO title page, the EN ISO foreword page, the ISO title page, pages ii to iv, pages 1 to 27 and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 14 July 2005

© BSI 14 July 2005

English version

Water quality - Determination of the elimination and
biodegradability of organic compounds in an aqueous medium -
Activated sludge simulation test (ISO 11733:2004)

Qualité de l'eau - Détermination de l'élimination et de la
biodégradabilité des composés organiques en milieu
aqueux - Essai de simulation des boues activées (ISO
11733:2004)

This European Standard was approved by CEN on 29 July 2004.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Foreword

This document (EN ISO 11733:2004) has been prepared by Technical Committee ISO/TC 147 "Water quality" in collaboration with Technical Committee CEN/TC 230 "Water analysis", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2005, and conflicting national standards shall be withdrawn at the latest by February 2005.

This document supersedes EN ISO 11733:1998.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Endorsement notice

The text of ISO 11733:2004 has been approved by CEN as EN ISO 11733:2004 without any modifications.

INTERNATIONAL STANDARD

**ISO
11733**

Second edition
2004-08-01

Water quality — Determination of the elimination and biodegradability of organic compounds in an aqueous medium — Activated sludge simulation test

*Qualité de l'eau — Détermination de l'élimination et de la
biodégradabilité des composés organiques en milieu aqueux — Essai
de simulation des boues activées*



Reference number
ISO 11733:2004(E)

AVA Documents
Document Sharing Hub

Contents

Page

Foreword.....	iv
1 Scope.....	1
2 Normative references	1
3 Terms and definitions	2
4 Principle	3
5 Test environment	4
6 Reagents	4
7 Apparatus.....	7
8 Procedure.....	8
8.1 General	8
8.2 Preparation of the inoculum	8
8.3 Performance of the test.....	8
9 Calculation and expression of results	11
9.1 Calculation of the degree of elimination.....	11
9.2 Expression of results.....	12
9.3 Indication of biodegradation.....	12
9.4 Biodegradation of the organic medium	12
10 Validity of the test	12
11 Test report.....	13
Annex A (informative) Modification of the activated sludge simulation test for nitrifying-denitrifying sewage treatment plants	14
Annex B (informative) Coupling of the test units (optional)	18
Annex C (informative) Test systems.....	19
Annex D (informative) Effects of sludge retention time on effluent concentration	22
Annex E (informative) Example of an elimination/degradation curve.....	25
Bibliography	26

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 11733 was prepared by Technical Committee ISO/TC 147, *Water quality*, Subcommittee SC 5, *Biological methods*.

This second edition cancels and replaces the first edition (ISO 11733:1995), which has been technically revised.

Water quality — Determination of the elimination and biodegradability of organic compounds in an aqueous medium — Activated sludge simulation test

WARNING AND SAFETY PRECAUTIONS — Activated sludge and sewage contain potentially pathogenic organisms, therefore appropriate precautions should be taken when handling them. Toxic test compounds and those whose properties are unknown should be handled with care.

1 Scope

This International Standard specifies a method for the determination of the elimination and the biodegradability of organic compounds by aerobic micro-organisms. The conditions described simulate a waste-water treatment plant. Two test systems can be used: activated sludge plants or porous pots. The tests can optionally be performed under conditions of nitrification and denitrification (Annex A) and coupling of the units (Annex B).

The method applies to organic compounds which, under the conditions of the test, are

- a) soluble in tap water at the test concentration and not expected to be transformed to insoluble metabolites if biodegradation, in addition to elimination, is determined;
- b) poorly water-soluble, but which are satisfactorily dispersible in water and allow detection with suitable analytical means (e.g. organic carbon measurements);
- c) non-volatile, or which have a negligible vapour pressure under the test conditions;
- d) not inhibitory to the test micro-organisms at the concentration chosen for the test. Inhibitory effects can be determined by using a suitable test method (e.g. ISO 8192^[15] or ISO 15522^[27]). Compounds inhibitory at concentrations used in this test may be tested at concentrations less than their EC₂₀ value, followed by higher practical concentrations after a period of acclimatization.

The method can also be used to measure the biodegradation and elimination of dissolved organic compounds in waste water (also called “test compound” in the method).

If more or different information is required to predict the behaviour of test compounds or waste water in a treatment plant, other degradation tests may be performed. For appropriate use of this method and for alternative biodegradation methods, see ISO/TR 15462 and for general information on biotesting, see ISO 5667-16.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 5667-16, *Water quality — Sampling — Part 16: Guidance on biotesting of samples*

ISO 10634, *Water quality — Guidance for the preparation and treatment of poorly water-soluble organic compounds for the subsequent evaluation of their biodegradability in an aqueous medium*

ISO/TR 15462, *Water quality — Selection of tests for biodegradability*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1

accelerating removal phase

(activated sludge simulation test) time from the end of the lag phase until the plateau phase is reached, during which the biodegradation of a compound or organic matter increases

NOTE Accelerating removal phase is expressed in days.

3.2

activated sludge

biomass and inert matter produced in the aerobic treatment of wastewater by the growth of bacteria and other micro-organisms in the presence of dissolved oxygen

3.3

chemical oxygen demand

COD

mass concentration of oxygen equivalent to the amount of a specified oxidant consumed by a chemical compound or organic matter when a water sample is treated with that oxidant under defined conditions

NOTE COD is expressed, in this case, as milligrams of oxygen consumed per milligram or per gram of test compound

3.4

concentration of suspended solids of an activated sludge

amount of solids obtained by filtration or centrifugation at known conditions of a known volume of activated sludge and drying at about 105 °C to constant weight

3.5

degree of elimination

biodegradation

(activated sludge simulation test) mean eliminated (biodegraded) amount of a chemical compound or organic matter, calculated from the measured concentrations in the inlet and the outlet of the system

NOTE The degree of elimination (biodegradation) is determined when no further elimination can be measured and is expressed as a percentage.

3.6

denitrification

reduction of nitrate and nitrite to the end product nitrogen (in the form of the gas) by the action of bacteria

3.7

dissolved organic carbon

DOC

part of the organic carbon in a sample of water which cannot be removed by specified phase separation

NOTE Phase separation may be obtained, for example, by centrifugation of the water sample at 40 000 m/s² for 15 min or by membrane-filtration using membranes with a pore size of 0,45 µm.

3.8

lag phase

(activated sludge simulation test) time from the start of a test until a significant elimination (biodegradation) of a compound or organic matter can be measured (the beginning of the accelerated removal phase)

NOTE The lag phase is expressed in days.

3.9**nitrification**

oxidation of ammonium salts by bacteria where usually the intermediate product is nitrite and the end product nitrate

3.10**plateau phase**

〈activated sludge simulation test〉 time from the end of the accelerating removal phase until the end of a test in which the biodegradation of a compound or organic matter is in a steady state

NOTE The plateau phase is expressed in days.

3.11**pre-exposure**

pre-incubation of an inoculum in the presence of the test compound or organic matter, with the aim of enhancing the ability of this inoculum to biodegrade the test compound by adaptation and/or selection of the micro-organisms

3.12**pre-conditioning**

pre-incubation of an inoculum under the conditions of the subsequent test in the absence of the test compound and other organic matter, with the aim of improving the performance of the test by acclimatization of the micro-organisms to the test conditions

3.13**primary biodegradation**

structural change (transformation) of a chemical compound by micro-organisms resulting in the loss of a specific property

3.14**total organic carbon****TOC**

all the carbon present in organic matter which is dissolved and suspended in the water

3.15**ultimate aerobic biodegradation**

breakdown of a chemical compound or organic matter by micro-organisms in the presence of oxygen to carbon dioxide, water and mineral salts of any other elements present (mineralization) and the production of new biomass

4 Principle

This method is designed to determine the elimination and, if possible, the primary or ultimate biodegradation of water-soluble organic compounds from water by aerobic micro-organisms in a continuously operating test system simulating the activated-sludge process. An easily biodegradable organic medium and the organic test compound are the sources of carbon and energy for the micro-organisms.

Two test units (activated sludge plants or porous pots) are run in parallel under identical conditions, normally with a mean hydraulic retention time, HRT, of 6 h (8.3.1) and a mean sludge retention time, SRT (sludge age), of 6 d to 10 d (8.3.3).

NOTE 1 HTR is the mean period of retention of waste water in the aeration vessel. It is calculated by dividing the volume of sludge, expressed in litres, by the rate of flow of waste water, expressed in litres per day.

NOTE 2 SRT is the mean period of retention of activated sludge in the aeration vessel. It is calculated by dividing the volume or weight of sludge in the aeration vessel by the volume or weight of sludge discarded per day. If a period of 8 days is chosen, remove 1/8 of the volume of the activated sludge of the aeration vessel each working day and discard it.